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D. L. BLACKSTONE, JR.

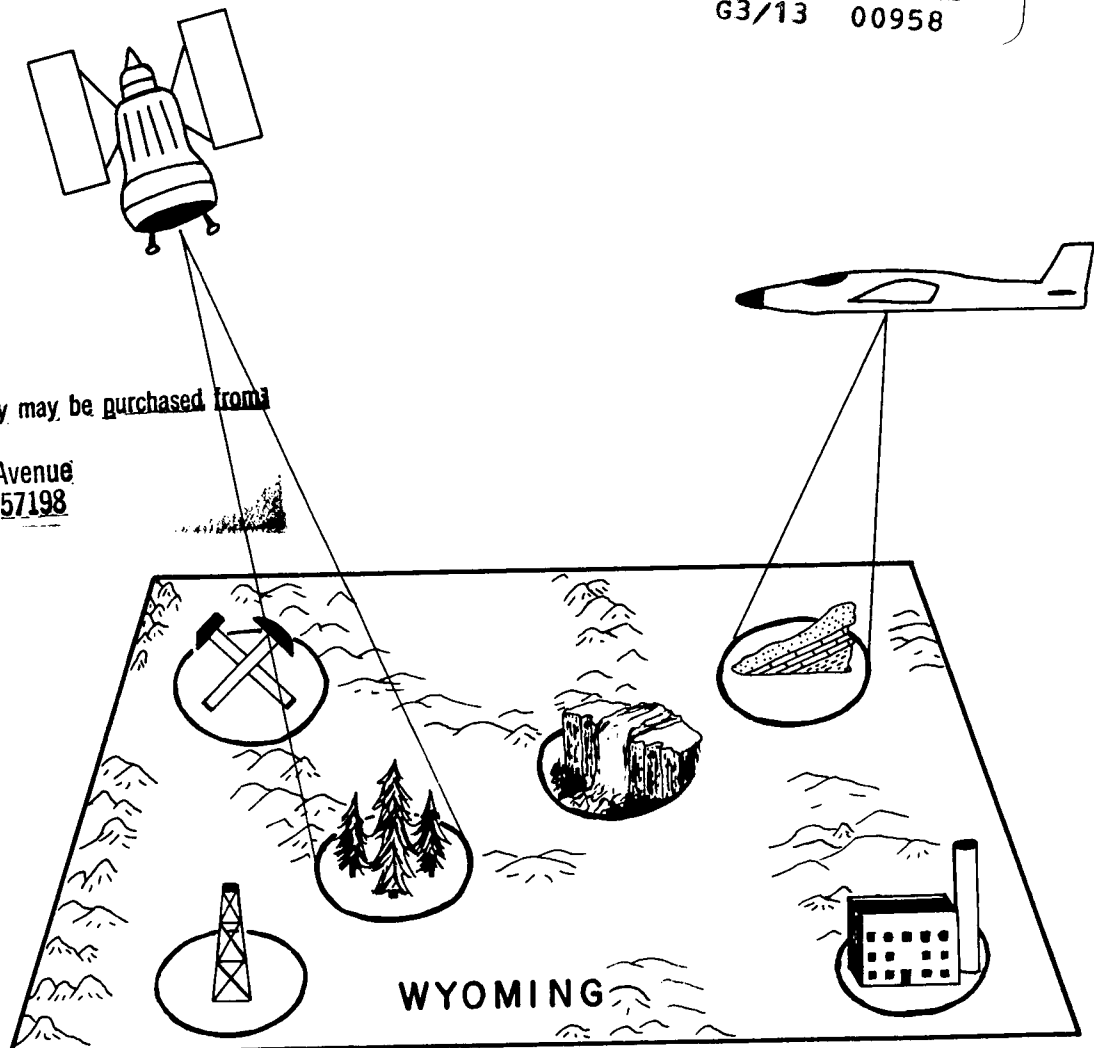
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Figure 2. Technical Report Standard Title Page

GEOLOGY OF PHOTO LINEAR ELEMENTS  
GREAT DIVIDE BASIN, WYOMING

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August 30, 1973  
Special Report

Prepared for

GODDARD SPACE FLIGHT CENTER

GREENBELT, MARYLAND 20771

# GEOLOGY OF PHOTO LINEAR ELEMENTS, GREAT DIVIDE BASIN, WYOMING

## INTRODUCTION

The Great Divide basin is a broad structural depression lying east of the Rock Springs Uplift, south of the Wind River Mountains, and Sweetwater Uplift, and east of the Rawlins Uplift. The southern boundary is the poorly defined Wamsutter Arch. The location of the area under consideration is shown on Fig. 1, and the major structural features are outlined on Fig. 4.

The structural basin does not fully coincide with the area of interior drainage that includes what has been called the Red Desert, Great Divide depression, etc. The Continental Divide separates into two strands in T. 27 N., R. 101 W., which diverge widely and enclose an area of about 4000 square miles before rejoining into a single divide near Divide Mountain in T. 18 N., R. 81 W. The area of internal drainage is characterized by extensive playa lake deposits, sand dunes, silt and clay dunes, saline lakes, and very few permanent streams. In part this area of internal drainage may result from the blocking of eastward flowing drainage by sand dune migration in the eastern part of the area.

The topography of the area examined is shown on the AMS topographic sheets at a scale of 1:250,000 (Casper, Rawlins, Lander, Rock Springs sheets); U.S. Geological Survey Topographic sheets at scale of 1:62,500 (Lost Creek Butte, Lost Creek Lake, Red Lake, and Five Fingers Butte); and at a scale of 1:24,000 (Wamsutter, Monument Lake, Hansen Lake, Ruby Knolls, Creston, Hansen Lake N.E., Sooner Reservoir, Battle Spring, and Antelope Reservoir sheets).

The features examined appear on ERTS imagery as follows:

1013-17300 bands 4, 5, 6, 7 and color composite

1030-17242 bands 4, 5, 6, 7 and color composite

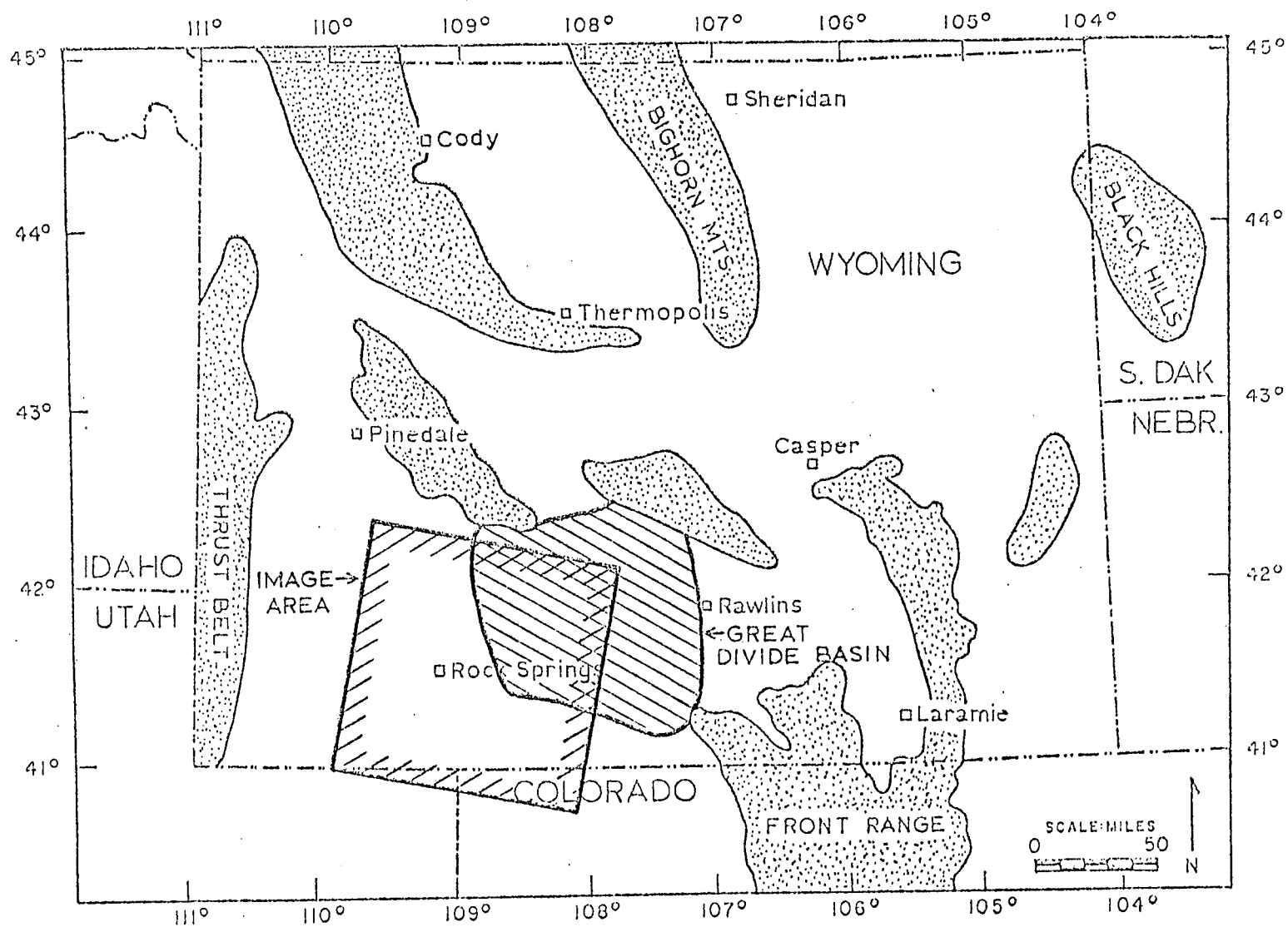


Figure 1. Index map showing location of the Great Divide Basin and the area covered by ERTS image 1013-17300.

The basic geology of the area is described by Schultz (1920), Bradley (1945), Pipiringos (1961), and Masursky (1962). A summary of the hydrologic characteristics of the area, as well as a compiled geologic map are presented by Welder and McGreevy (1966). Numerous papers deal with details of mineralogy, stratigraphy etc. but are not included in the references. A full list of references is provided by Pipiringos (1961).

#### ACKNOWLEDGEMENTS

Thanks are due to Dr. Ronald W. Marrs for support services related to the project.

#### GEOLOGIC STRUCTURE

The Great Divide basin was redefined by Love (1961) essentially as described in the first paragraph of this report. The rocks exposed at the surface are for the most part of Eocene age, with several facies variations the most important of which is the increasing grain size and change to arkose to the north. The dips of the strata within the area are generally less than five degrees. Topographic expression of the rock units in the form of cuestas is very slight.

The geologic structure is obscured by the extensive Quaternary deposits which cover more than 25 percent of the area.

#### PHOTO LINEAR ELEMENTS

##### Tipton (#1, Fig. 3)

Examination of the imagery reveals photo linear elements with a northeast-southwest trend which extend eastward from the Rock Springs Uplift across the Great Divide basin (Figs. 2 and 3).

A ground examination was undertaken to determine the nature, and geologic control of such photo linear elements.



Figure 2. ERTS-1 image 1013-17300 covering the Rock Springs/Great Divide Basin area.



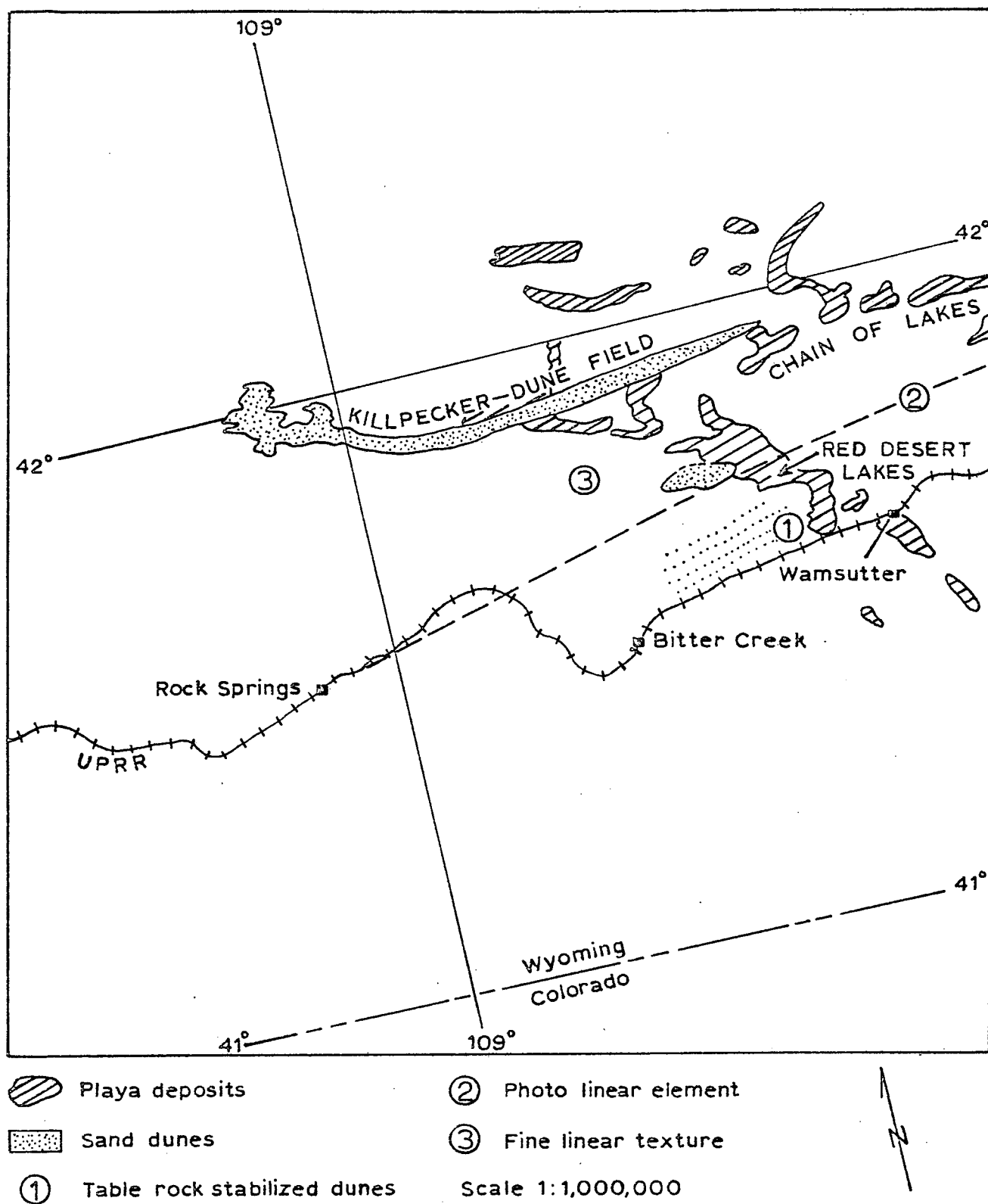


Figure 3. Major linear features of the Great Divide Basin (from ERTS-1 image interpretation).



Figure 3 outlines the major photo linear elements and can be compared with Fig. 4 to see the relationship to the major tectonic elements.

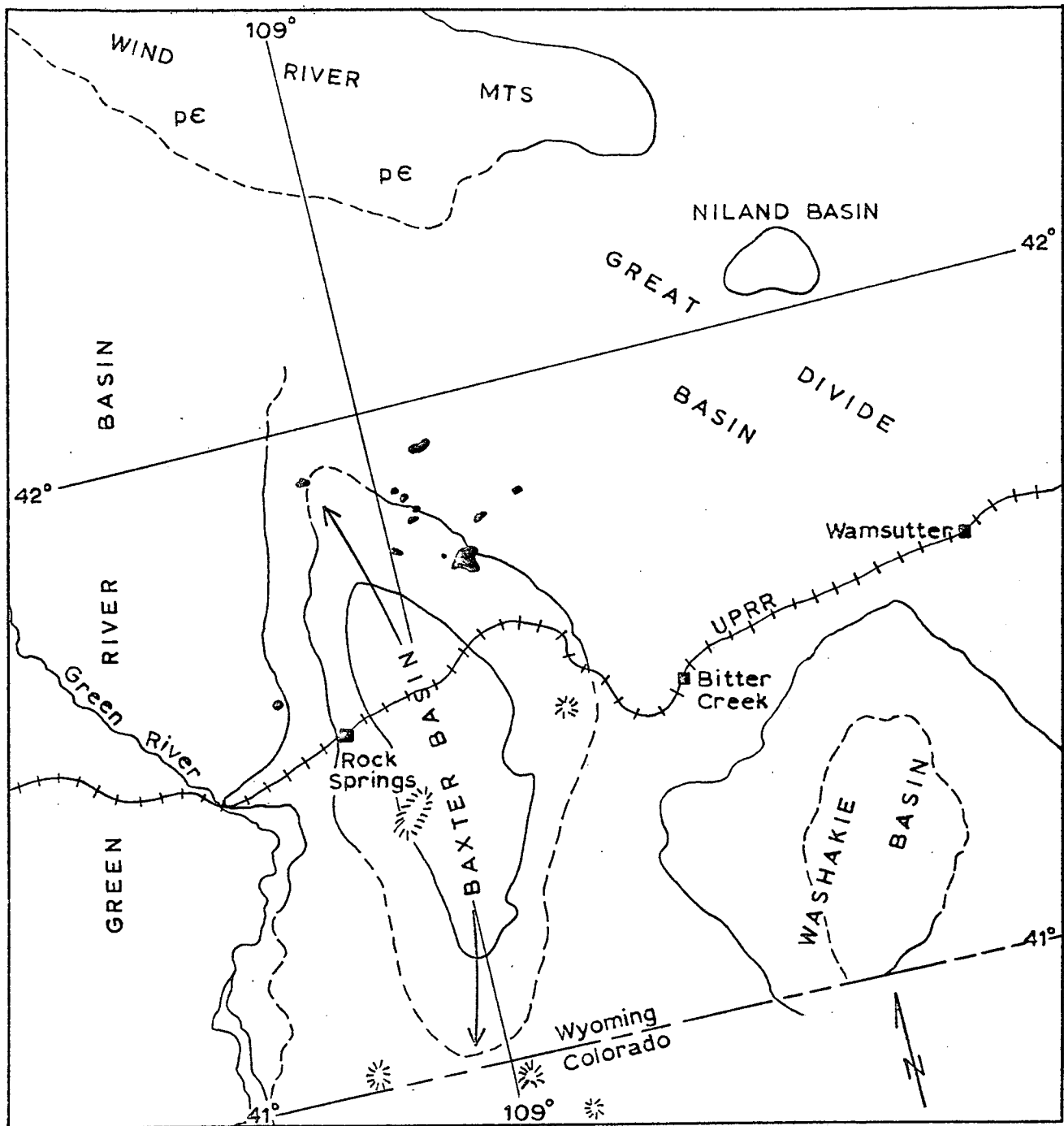
Immediately north of U.S. Highway I-80 (U.S. 30) at Tipton Siding the imagery shows an area of strongly striped ground. The area is about 20 miles in length and about 10 miles in width. First examination of the imagery suggests some type of fault control but ground elevation examination reveals that the striped ground is the site of linear strips of stabilized sand dunes of moderate relief. Within each dune belt strip are blowouts and short transverse dunes.

The dunes are stabilized by greasewood (*Sarcobatus* sp.) rabbit brush (*Chrysothamnus* sp.) and other minor species which have a contrasting color, and also are markedly different in color value from the sagebrush (*Artemisia* sp.) which is the common shrubbery cover of the region. A more detailed treatment of the relationship between Wyoming sand dunes and the stabilizing vegetation will be presented in separate ERTS-1 special report now being completed by Mr. Ken Kolm of the University of Wyoming Geology Department.

The alignment of the dunes is about N 75 E. This trend is more northeasterly than the prominent and presently active Killpecker dune field in the northern part of the basin. The distribution of the dunes is limited on the east by the rising series of escarpments encircling the northern flank of the Washakie Basin. The dune area essentially terminates along the eastern end in the Red Desert playa.

#### Point of Rocks (#2, Fig. 3)

A second more subtle photo linear feature crosses the area in a N. 80 E. direction beginning near Point of Rocks siding and continuing northeasterly to a point about due north of Creston, Wyoming. The linear element appears on the color positive transparency image as a faint line which at times appears lighter



★ Leucite Hills volcanic rocks

Scale 1:1,000,000

Figure 4. Major structural elements of the Great Divide Basin, Wyoming.

than the surrounding terrane and at other places appears darker.

Several traverses were made in a north-south direction across the linear element in the area between Table Rock and Creston Junction, north of U.S. Highway 1-80. Specific ground control was sought to establish the nature of the linear elements.

Particular attention was given to geomorphic form, stream alignment, observable bedrock geology which might reveal faulting, vegetational changes, distribution of playa deposits, and aeolian features.

The result of the traverses was negative with regard to critically defining the nature of the photo linear element, #2, (Fig. 3). No positive faulting was found. Minor faulting with a trend of approximately N 65 E has been reported by Pipiringos (1961) and by Masursky (1962) in the Great Divide basin. These faults are reported to have displacements up to 70 feet. Unfortunately this system of fractures does not coincide in position with the feature under consideration. The low relief and widespread Quaternary deposits made detailed examination of the bedrock very difficult. Previous mapping is undoubtedly detailed enough to fully define the bedrock structure.

#### Recommendation

To fully evaluate linear element #2 (Fig. 3), seen on the ERTS imagery additional low-level color photography is necessary. With such photocoverage, additional field work, including detailed joint measurements, should be carried out. Subsurface studies based on available drill records from petroleum exploration have not revealed any major northeast oriented faulting in the area.

#### ALTERNATE CAUSES FOR PHOTO LINEAR ELEMENTS

The Great Divide basin area is characterized by internal drainage and the phenomena associated with such drainage situations. To date no single paper

has discussed geomorphology and origin of the internal drainage in this basin. In fact only in 1964 did the topographic base map of Wyoming reflect the dual divide. The most complete presentation of the geology is that in the Hydrologic Atlas 219 by Welder and McGreevy (1966). The geomorphic history is complex, and warrants study as to its origin.

The playa lake flats are the site of a limited amount of lacustrine deposition, but the depressions in which the playas exist must be due in part to an earlier cycle of deflation. The material removed from these sites must be accounted for even if transported considerable distance.

The total effects of wind action, both deflational and depositional are very large in this region. The extensive Killpecker dune field is still partially active, and is perhaps the most striking example, though there are extensive areas of active dunes in the eastern part of Separation Flats. The results of wind action in other parts of the Great Divide basin are less pronounced though several areas of stabilized dunes (Feature 1, Fig. 3) are present.

In many areas thin strands of completely stabilized linear dunes can be seen. These appear on the ground as low ridges often clothed in sagebrush (Artemesia sp.) though other plants such as rabbit brush (Chrysothamus sp.) favor this environment. The ridges are from two to ten feet in height and locally somewhat higher, 10 to 30 feet in width and vary in length from tens to hundreds of feet. The dunes are unobtrusive on first inspection, and become evident only as the observer learns to discriminate these forms from the bedrock vegetation association.

The total effect of the distribution of these smaller, finer linear dunes is to give a northeast trending grain to certain areas of topography which might be interpreted as a bedrock structural grain.

The scale of the imagery precludes final judgment as to how much of the photo linear aspect is due to aeolian action, rather than bedrock control. At present this investigator believes that wind created phenomena are far more pervasive than previously considered insofar as this particular region is considered.

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